DOCUMENT RESUME

ED 432 647 UD 033 064

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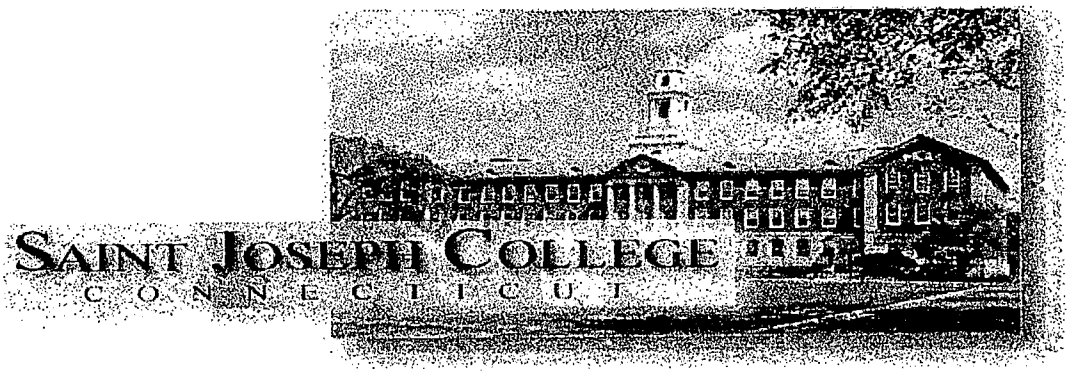
TITLE	A College and Urban Elementary Classroom Collaborate in Using Writing To Learn in Science.
PUB DATE	1998-05-00
NOTE	11p.; Paper presented at the Annual Meeting of the International Reading Association (43rd, Orlando, FL, May 3-8, 1998).
PUB TYPE	Reports - Descriptive (141) -- Speeches/Meeting Papers (150)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Bilingual Education; *College School Cooperation; *Elementary School Students; Higher Education; *Interdisciplinary Approach; Intermediate Grades; *Science Instruction; Spanish; Teaching Methods; Transitional Programs; Urban Schools; *Urban Youth; Writing Across the Curriculum; *Writing Instruction

ABSTRACT

In a fifth-grade transitional bilingual class in Hartford (Connecticut), a project was conducted to focus on writing to learn in science. The process of writing facilitates development of critical thinking, deepens understanding of science content, and develops collaborative learning skills. The example of a set of lessons on the skeleton illustrates how students write their own books about the skeleton. The book format created student interest and enhanced motivation, but experiences with this project indicate that some adjustments are needed to teach the lessons in the future. Among the problems was the limited technical vocabulary of these students who were learning English. In addition, the school lacked reference materials in English and Spanish to support student learning. Results indicate that students writing to learn in science used writing to understand the science content and then improved their writing through the projects. (Contains 11 references.) (SLD)

A College and Urban Elementary Classroom Collaborate in Using Writing to Learn in Science



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International Reading Association 43rd Annual Convention
Orlando, FL
May 3-8, 1998

Introduction

The Hartford Public School District is the largest school district in Connecticut Enrollment is 98% minority, predominantly Hispanic and African American. The district enrolls approximately 4% of Connecticut's public school students, 49.6% of whom are bilingual and 13.07% receive special education services. Although Connecticut's per capita income ranks among the highest in the nation, paradoxically, Hartford's dropout rate, poverty index, adolescent crime, teenage pregnancy, infant mortality, and unemployment also rank among the highest in the nation. This collaborative project takes place in Mrs. Lord's fifth grade transition bilingual class which reflects the above statistics. However, statistics fail to capture to humanity and dignity of the children living under these conditions. This project attempts to share our human and academic experience which focused on writing to learn in science.

Linking Writing to Learning the Content

Writing in science is thinking on paper. The process of writing facilitates development of critical thinking, deepens understanding of science content, develops collaborative learning skills. Also, writing serves to reinforce knowledge of concepts, principles, and skills learned through reading, speaking, listening, viewing, and visually representing. Writing invites students to think about the content by revisiting their ideas. It fosters critical thinking through the process of generating, sorting and clarifying understandings and ideas. The permanence of the written word invites reflection.

Table 1
Expressive Writing

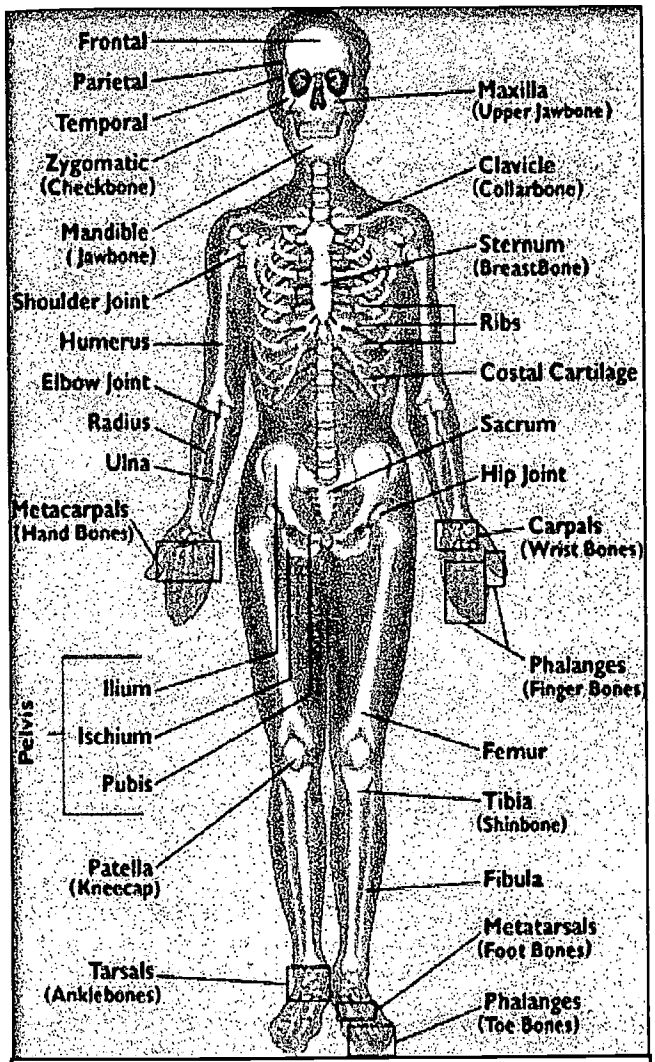
- ***Writing to Gain Access to Prior Knowledge***
  - ***Free Writing***
  - ***Fact Storming***
  - ***K - W - L***
  - ***Semantic Maps***
  - ***Problem Analyses***
- ***Writing to Preserve and Express Ideas***
  - ***Log Keeping***
  - ***Note Taking***
  - ***Journal Writing***
  - ***Summaries***
  - ***Peer dialogues***
  - ***Class notes***

Writing to learn in the content areas seems to be divisible into two categories: Expressive writing that allows a student to explore personal thinking without concern for conventions and product writing which is more formal and requires attention to the appearance of literacy (Sorensen, 1998). although not exhaustive, Tables 1 and 2 give some examples of expressive and productive writing across the curriculum.

However, writing in science is a part of a bigger picture of **literacy** development. Students cannot write without at least some knowledge of the topic. In order to facilitate student use of writing in science, students must read with comprehension and gain content knowledge in many different ways in order to write meaningfully.

Table 2
Product Writing

- ***Essays***
- ***Research Reports***
- ***Lab Reports***
- ***Book reports***
- ***Dialogue to persuade***
- ***Editorial***
- ***Letter to the editor***
- ***Speech***
- ***Review a book, movie, documentary***
- ***News reports***
- ***Newspaper articles***
- ***Commercials***
- ***Advertisements***



http://www.healthnet.ivi.com/bh/anatomy/htm/tc6d161.htm

The Human Skeleton

Lesson I

Objective:
The students will write to explore their knowledge of bones.

Initiation:
Students will write in a science journal in response to the following questions:

* What part of your body moves when you walk?

* What part of your body moves when you run?

Teacher will model her predictions on an overhead transparency; students will add to their predictions to make a class list.

Procedure:
Students will **predict** which parts of their body move when jumping rope.

* Generate a class list.

In pairs, students jump rope recording their **observations**. This activity is followed by a recording of the observations for the whole class.

As a class, discuss the different things the skeleton does for the body.

The class should generate the following:

* Protects the body: brain, heart, lungs, kidney (internal organs)
* Supports the body: legs, arms, spinal columns
* Moves the body: walk, run, crawl, skip

Closure:
What did your do today in science?
What did you think?
What did you feel?
Set purpose for next week:
What do you want to learn about the human skeleton?

The Human Skeleton

Lesson II

Objective:
The students will
* write to explore their knowledge of the number of bones in the human body.
* construct a model of the human skeleton.
* explore the significance of bones in their daily lives.

Initiation:
Would you review your notes from last week's class to recall the questions you had about the human skeleton.

Create a class list of student questions.

Procedures:
Collaborative Group Work: (Four groups, each counts two of the categories of bones.)

Four Groups	Count	Average
Arm & Hand		
Leg & Foot		
Skull		
Torso		
Total _____	_____	_____

Revise the Total Bone Count:
Share with the group the actual count of bones.
If you have Internet access, you can go to **Click the Bones & They Will Speak** at http://www.cs.brown.edu/people/oa/Bin/skeleton.html

Students construct Mr. Bones Puzzle using the pieces and fasteners prepared before class.

Closure:
What did you do?
What did you think?
What did you feel?

The Human Skeleton

Lesson III

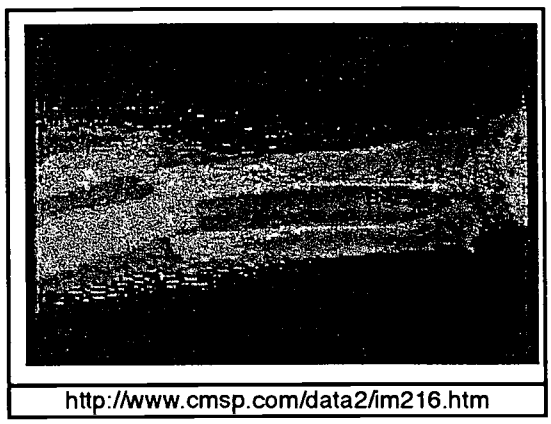
Objective:

The students will use the writing process strategies of brainstorming, planning, composing, and conferencing to create a draft writing product reflecting on leaning about the skeleton using the prompt below:

> *Have you or anyone you know broken a bone? which one(s)? How did it feel at the time and during the healing process? If you have not had such an experience, pretend that this is happening to you.*

Initiation:

Share pictures an xray of Viesha's broken arm. Tell how she broke it, fell down stairs; the trip to the hospital; how it restricted her movements; the healing and itching; the saw to cut off the cast and how it scared her, etc.



http://www.cmsp.com/data2/im216.htm

Procedures:

Share the prompt and brainstorm their "stories."

Create a web which organizes common ideas such as how, when, where, who, how, why.

Each student will write individual stories, including the teacher.

After twenty minutes of writing, engage in conferences which will call for students to jot down ideas they had heard from another student and may be included in their won narratives. The purpose of the conference is to gather ideas from others that should be included in ones own narrative. It is not to give the reader feedback.

* Model the process with a transparency.

Closure:

What did your do today in science?
What did you think?
What did you feel?

The Human Skeleton
Lesson IV (Two weeks)

Since this is a relatively long term project, only the overall plan is delineated. It is important to remember that the above three lessons served to create a base of experiential knowledge that served as an introduction to the writing of this report which took the form of a flip - up book.

Objective:

The students will

* use the writing process strategies of brainstorming, researching, planning, composing, conferencing, revising, and editing to publish a flip - up book reflecting their knowledge of the skeleton.
* recognize reliable sources of information.
* distinguish between fact and opinion.

Procedures:

There are four general phases to this project

1. Identify the basic skeletal parts to be studied
2. Search for information
3. Take notes, synthesize data, write draft, revise and edit
4. Write and illustrate the report

Table 3

My Bones!

Toe bone connected to the foot bone.

Foot bone connected to the ankle bone.

Ankle bone connected to the leg bone.

Leg bone connected to the knee bone.

Knee bone connected to the thigh bone.

Thigh bone connected to the hip bone.

Hip bone connected to the back bone.

Back bone connected to the shoulder bone.

Shoulder bone connected to the neck bone.

Neck bone connected to the head bone.

Some of my bones!

The teacher explains to the class that each student will creating an individual report that would be published in the form of a book. The class is shown a model of a flip - up book. Each student receives an individual copy in which to write and illustrate the report. They are given the children's song, Table 3, to guide their search and organization for data. This organizational structure is deemed essential for the bilingual nature of the class. The falimiarilty of the song will make it easier for the students to keep track of their work.

Next, the teacher shows how to find information . Students use children's books, encyclopedias, Internet resources, anatomy reference books, and medical brochures to gather information. We discovered a woeful lack of materials in the school library which will be discussed later.

Following of the above preparation, students read, take note, and follow the writing process in the creation of their report which culminates in the writing and illustrating of the personal book. The book format is used to create interest and motivation.

Lesson and Project Analysis

Lesson and project analysis will focus on assessment of student learning during lesson and adjustments to lesson/project if taught with a similar group of students next time.

Assessment of Student Learning During Lesson/Project

Whole class grouping for instruction appeared most successful in facilitating learning. Table 4 records student responses to one lesson **Initiation** which called for students to **review their journals** and set a purpose for learning. Student responses included two categories information. Students were asked to speculate why the responses were separated on the transparency. They were immediately able to identify the fact that the second set of questions did not relate to the skeleton specifically.

Table 4
Initiation

What do we want to learn about the human body?

* How many bones do we have?
* How does the skeleton support us?
* Do the bones have names?
* How do the bones keep us moving?
* I want to learn what is inside the body.
* How do the bones work for the heart?
* How does the body really work inside me?

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* How does the blood get inside my body?
* How does the heart get its blood?
* How do the lungs, liver, and kidney work?

On the other hand, **Collaborative Group Work**, such as the **Bone Count**, did not go as well as expected, at times, because of our inadequate assessment of students' prior knowledge. It turned out that students did not understand some terms such as **torso**. They had difficulty determining where one body part ended and another one began. This served to underscore the importance of activating prior knowledge, reviewing technical vocabulary, and addressing misconceptions. However, activities such as the **Revised Total Bone Count** activity went well when we realized the need for more and information! We displayed a labeled poster of the skeleton and the students actually counted the bones and recognized what they had missed in their estimations .

Individual work such as the hands-on **Mr. Bones Puzzle** was wonderful. Students were very interested and successful in creating a human skeleton. Most students needed a 'picture' of a skeleton to guide their efforts. We often observed the students comparing their emerging skeleton with that in the picture as well as examining their own bodies to see how the pieces of the puzzle should fit.

The individual writing to the "broken bone experience" prompt produced some incredible personal stories. Every child had a story waiting to be told! Alexi wrote about being in a motorcycle accident which resulted in a broken leg and being given a "needle to calm down." Jesus told with humor about the pillow fight that resulted in his getting fourteen stitches in his head. Sandra wrote about witnessing her girlfriend being hit by a car. She writes,

"...the floor was covered with blood....The ambulance came and took her...In the night I could not sleep because I was crying so much (and) when I closed my eyes I start to dream about her..."

In addition, a summary, Table 5, of one lesson's **Closure** comments indicates the achievement of the objective and the joy of learning which was generated by these science activities. An analysis of student science journals reveals that all students created the number of bones estimation chart and wrote their estimates as directed. Student counts/estimation tended to be much smaller than the real count because they did not know that the seeming bone segments were actually distinct bones. Student feedback about writing the personal accident story shows that they enjoyed writing their stories, had many personal experiences that they wished to share, expressed the desire to revised and publish their stories, and finally one student expressed the feelings of the whole class when she wrote,

" I feel like going back to that story and reading it over and over."

Table 5

Closure

What did you do?

* We counted how many bones we have.
* We wrote in our science journals.
* We tried to guess/count how many bones we have.

What did you think?

* I think today is a special day because we studied the human, something I wanted to know more about.
* I was learning a lot about bones and the body.

What did you feel?

* I feel excited.

In summary, student work and comments indicate a desire to learn and an ability to express their ideas in writing when students possess content knowledge. These children had no difficulty expressing themselves when they experienced the events.

Adjustments to Lesson/Project

Our experiences with this project indicate the need for some adjustments to the lessons if they were taught with a similar group of students next time. The research project needed many adjustments while in progress and will require further adjustments in the future. Three major issues developed. One, since this was the first time these fifth grade students were undertaking such an extensive project, creating individual books proved to be time consuming. Second, students' knowledge of English was limited in terms of technical vocabulary, therefore, the teacher had to frequently provide the Spanish translation. Third, the school library lacked English and Spanish reference resources on the human body forcing the teacher to take the entire class to the public library in the community.

These three issues are actually intertwined. The first problem to arise was the lack of reference materials in the library. Both the classroom teacher and the researcher

brought in books from our personal libraries. However, Mrs. Lord had to ultimately walk the entire class to the local branch of the Hartford Public Library in order to take out books for the research project. This situation shed some light on the use of ready made science kits for instruction in the elementary grades. Hartford Public Schools purchased many such kits with the goal of making science instruction easier and, therefore, more likely to occur. Our experience with such kits showed that although they did facilitate short term instruction by providing many of the materials needed to teach quick lessons such as putting to gather a skeleton puzzle or labeling skeletal parts on a ditto, long term instruction such as a report writing was not addressed. In our experience, the kits reinforced a very negative work ethic! It made it seem that learning and work can be finished in one hour blocks of time!

At the end of the school year, the teachers were informed that there was an extra $15,000 to spend and what did they want to purchase. Both the teacher and the researcher felt that if truth be told, we hoped that the money would go toward some great literature for the classrooms rather than kits. The kits were limiting rather than expanding opportunities. Just look at what the class had to do just to do some research. The school system must invest in classroom libraries which support the implementation of the curriculum. The fifth grade science curriculum focuses on application of the scientific method, investigation of interactions of populations with the environment, energy uses and conservation of the environment. Such lofty goals do not come in a kit!

In addition, students in bilingual programs need materials written in Spanish and in English. Their lack of English should not stand in the way of learning new content. Our experiences attest to the need for hands-on activities to bring the science content to life and make it an integral part of each student's being. Therefore, in addition to written materials, the school system must help teachers design and implement hands-on projects. These are costly in terms of time and resources. However, it is the school's responsibility to address these needs.

Finally, the research project would have been more effectively done as a collaborative rather than an individual project. As the project progressed we realized that asking each student to research ten bones was overwhelming. By the end of the project everyone, including the teacher, just wanted to finish it! Structuring the book as a collaborative project would have sustained interest and facilitated greater in depth learning. Also, the lack of materials made the research go slowly since students had to frequently wait for the few books available to them. Once again, collaboration would have minimized this problem.

In summary, writing to learn in science benefits students in two ways: they used writing to better understand content and they began to write better. Our students answered their initial questions about the skeleton through their research and engaging in the writing process which resulted in the publication of the books improved students writing skills.

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